

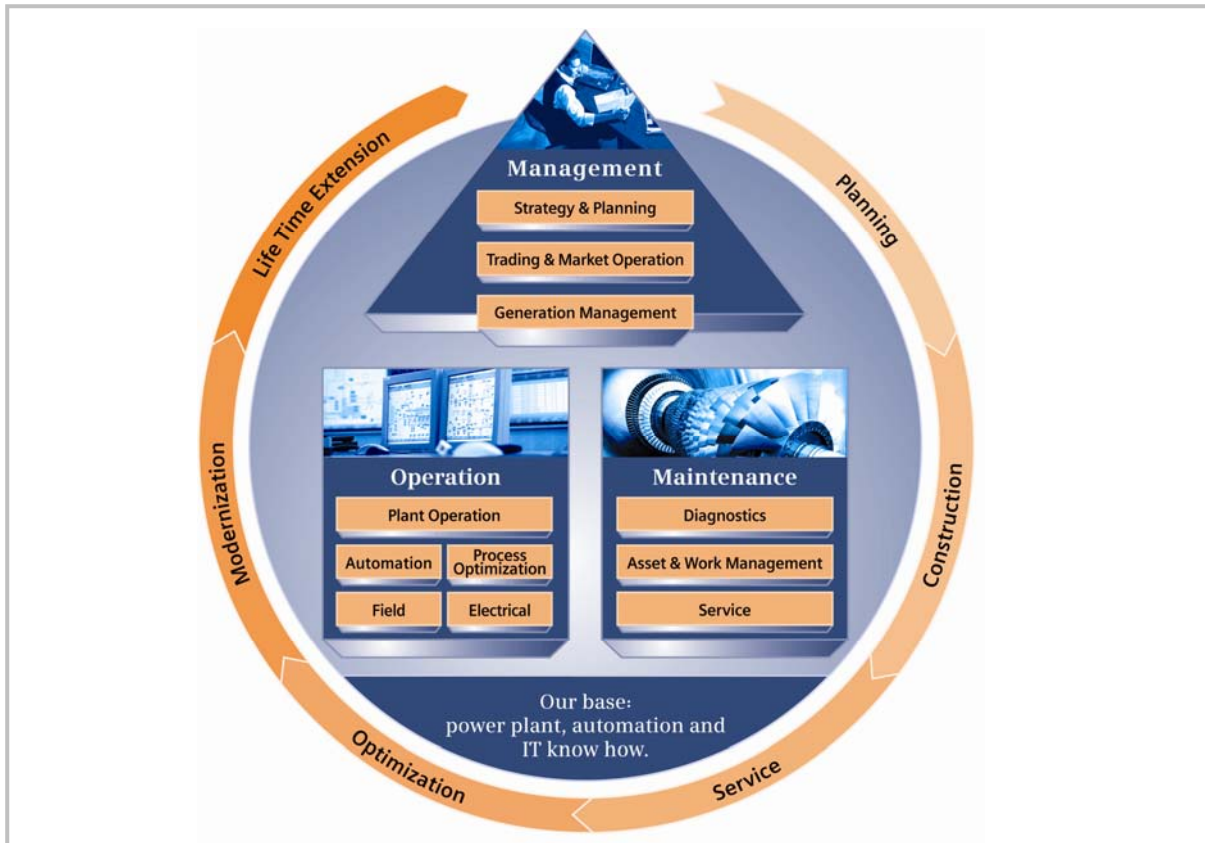


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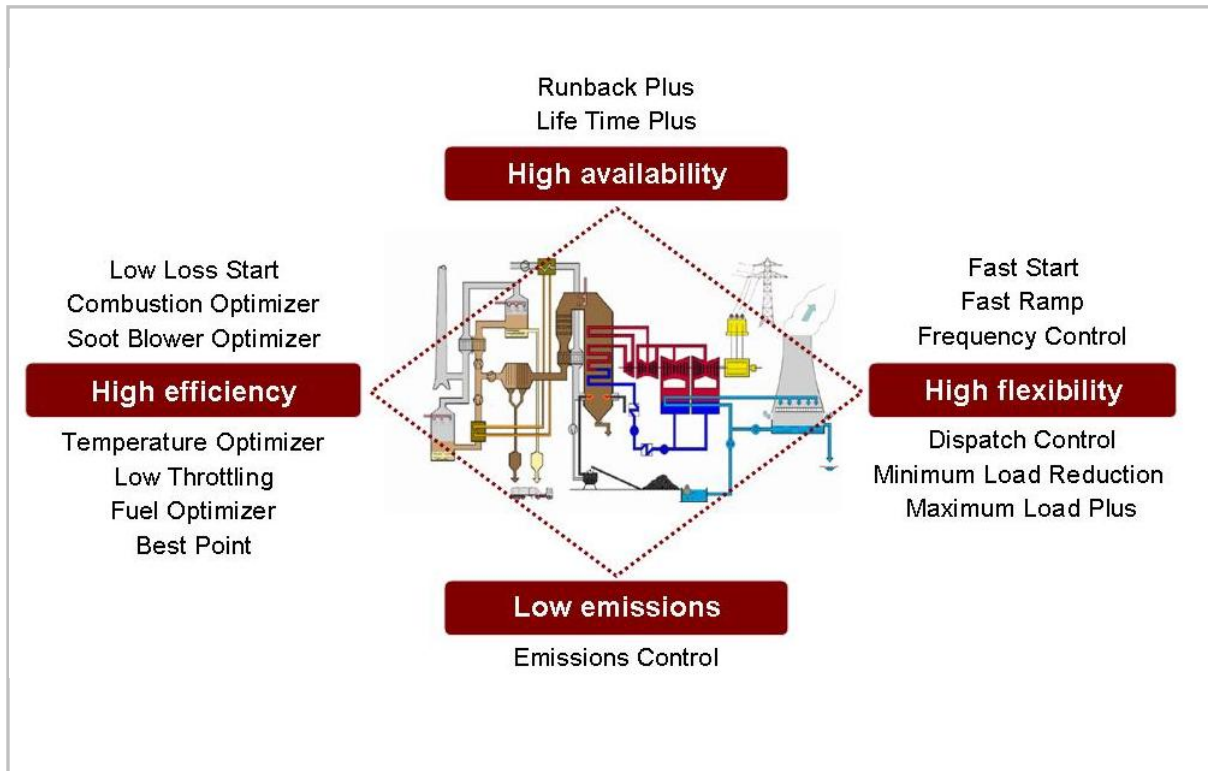
## SPPA-P3000 Solutions for Process Optimization

Siemens Power Plant Automation





Siemens Power Generation · Instrumentation & Controls,  
the comprehensive solutions provider for the energy industry



The goals of the process optimization and the SPPA-P3000 Solutions.

## Solutions for process optimization

Optimizing processes in the power plant is one of the most demanding tasks of all. Especially if it is to be achieved without costly modifications on the mechanical engineering side, i.e. without major conversions to the steam generator and turbine.

This purely software-oriented approach followed by Siemens has been an ongoing success in the world's power plants for just on a decade now and has made many operators happy people – especially when they think about their ROI (return on investment).

Besides being widely incorporated into new power plants, the **Siemens Power Plant Automation Solutions for Process Optimization SPPA-P3000** are nowadays a popular choice for power plant upgrades..

The most profitable operating point differs for each plant and can even vary over time as a function of market requirements.

SPPA-P3000 Solutions allow a power plant unit to always be operated at the most profitable operating point, which calls above all for greater flexibility and higher efficiency, better availability and lower emissions.

### High flexibility

SPPA-P3000 Solutions enable optimum response to load demands. Our control concepts together with the extension of the operating range of the subordinate controls to lower minimum and higher maximum loads lay the foundations for flexible and at the same time stable operation.

#### Benefits:

- Increased revenue by provision of additional primary and secondary control capability.
- Increased revenue or reduced financial losses thanks to consistent start-up capability, low cost start-up, reduced minimum or increased maximum load levels and fast response to changing load requirements.

### High efficiency

SPPA-P3000 Solutions improve overall efficiency by various efficiency enhancement approaches which include reduction of valve throttling losses, optimization of combustion air, steam temperature or of cooling water.

#### Benefits:

Improved efficiency can be used to either

- Reduce fuel costs for the same level of power sales

or

- Increase revenue from additional power sales for the same level of fuel cost.

### High availability

Implementation of model based feedforward control in SPPA-P3000 Solutions allows fuel overfiring to be reduced and the number of control actions to be kept to an absolute minimum. This simultaneously reduces operating life consumption effects on components.

Thanks to the tried and tested load capability circuit, the plant avoids tripping on the loss of major components.

#### Benefits:

- Reduced frequency of failures thanks to low-stress operation
- Reduced frequency of trips as load capability circuit enables plant to ride loss of major components

### Low emissions

SPPA-P3000 Solutions achieve a reduction in emissions through stable plant operation and continuous operating point optimization for the separate burners.

Any increase in efficiency yields a simultaneous reduction in CO<sub>2</sub> emissions.

#### Benefits:

- Compliance with statutory emissions limits and avoidance of financial penalties for violations of these
- Revenue from sale of superfluous emissions credits
- Higher price can be realized for sale of ash

## High flexibility



### Fast Start

#### Get back on the grid faster

To get the unit back on the grid in the shortest possible time without thermal stresses for thick-walled components violating permissible limits.

**Fast Start** minimizes startup time while ensuring that thermal stresses for thick-walled components do not violate permissible limits. In most cases, a further bonus of reduced startup time is a significant reduction in fuel consumption.

### Minimum Load Reduction

#### Reduce minimum load level

A particular feature of oil- and gas-fired units is that there are certain times of day when power prices can fall below their generating costs. There are a number of considerations that may rule out shutdown of units under these conditions, such as when the units involved feature district heat extraction and are thus subject to the stringent requirements imposed for security of supply for district heat.

**Minimum Load Reduction** reduces the minimum load level for a unit, and thus minimizes the financial losses sustained in such periods of unprofitable operation.

### Maximum Load Plus

#### Increase electrical output to above 100%

There are times when the price for power on the spot market is so high that it can be extremely lucrative for plant owner/operators to operate their plants loads in excess of 100 %.

**Maximum Load Plus** enables maximum output to be increased above 100% for unchanged main steam mass flow by smooth and controlled partial or full deactivation of the HP feedwater heaters.

### Fast Ramp

#### Respond reliably and fast to market requirements

The faster a power plant unit can respond to changing load situations, the higher the financial benefit it can reap.

**Fast Ramp** coordinates steam generator and turbine, mobilizing stored energy in the power plant process to give precise and repeatable load changes.

### Frequency Control

#### Increase range for frequency control

Provision of primary frequency control and spinning reserve is becoming a steadily more lucrative service. Due to the fast load ramps that this service requires, it places very high demands on the dynamic control response of a power plant unit.

**Frequency Control** enables reliable and cost-effective provision of primary frequency control and spinning reserve.

### Dispatch Control

#### Increase window for dispatcher control

Load cycling under grid dispatcher control for provision of secondary frequency control capability (ADS/AGC, etc.) is becoming a steadily more lucrative service. Due to the fast load ramps that this service requires, it places very high demands on the dynamic control response of a power plant unit.

**Dispatch Control** enables reliable and cost-effective provision of secondary frequency control capability.

## High efficiency

### Low Loss Start

#### Start-up with minimum losses

Startup of a plant unit is a costly process, as no power sales are possible for its duration with utilization of premium fuels such as oil and gas necessary even in the case of coal-fired units.

**Low Loss Start** minimizes fuel consumption during the startup process while ensuring that thermal stresses for thick-walled components do not violate permissible limits. In most cases, a further bonus in addition to reduced fuel consumption is a significant reduction in startup time.

### Best Point

#### Operate plant at optimum operating point

It is often difficult to identify departures from the optimum operating point for a power plant. The cost penalties incurred as a result likewise often remain unknown.

**Best Point** performs continuous analysis, monitoring and optimization of the overall process and key components. It supplies information about any departure from optimum conditions, calculates the resulting costs and highlights improvement potential.

### Sootblower Optimizer

#### Optimize operation of sootblowers

The optimum point at which to perform sootblowing is set by the constraints of minimizing costs for soot blowing and the losses caused by fouling of heat exchange surfaces.

**Sootblower Optimizer** calculates the optimum point for sootblowing for each separate sootblower group as a function of current condition of the associated heat exchange surfaces.

### Combustion Optimizer

#### Increase efficiency, lower emissions

The optimum operating point for a burner firing coal depends on a number of factors. The central one is pulverized coal flow to the burner, a parameter not easily measured, with the condition of the burner and of the pulverizers also having an impact here.

**Combustion Optimizer** measures pulverized coal flow admitted to a burner, optimizing operation of the separate burners on this basis.

### Temperature Optimizer

#### Increase temperatures close to limits

Reliably holding superheat and reheat steam temperatures at their setpoint is of decisive importance both for plant efficiency and for plant capability to perform fast load changes.

**Temperature Optimizer** optimizes control action by the various final control elements used for temperature control during startup and over the entire load range. These include spray atomizers, flue gas recirculation control elements, biflux and triflux control valves, flue gas backpass dampers and tilting burners.

The lower-level temperature controls ensure that temperatures will be reliably held at their setpoints.

### Fuel Optimizer

#### Operate efficient and reliable despite firing of different fuels

Firing of low-cost supplementary fuels and of fuels with widely fluctuating properties place stringent demands on the control systems of a power plant. This is particularly the case for the load and air control systems for the steam generator.

**Fuel Optimizer** allows minimization of fuel costs while at the same time ensuring stable operation of the power plant unit.

### Low Throttling

#### Reduce throttling losses

**Low Throttling** reduces the degree of throttling for turbine valves, feedwater control valves and fan vanes for forced- and induced-draft fans to the amount actually needed to permit these to meet dynamic response requirements without any negative impact on load flexibility.



## High availability

### Runback Plus

#### Ride out loss of major components

In the event of loss of a major component such as a feedwater pump or induced-draft fan,

**Runback Plus** then automatically performs stable and reliable fast runback of the plant to the new maximum level that is permissible without the component concerned. This action allows the unit to ride out this condition, avoiding an outage of the entire unit.

### Life Time Plus

#### Increase availability through low-stress operation

Regardless of all the demands for high efficiency and flexibility, low-stress operation remains a fundamental requirement.

Thanks to its model based and predictive feed-forward control and mobilization of stored energy, **Life Time Plus** enables stable and precise load changes with minimum fuel overshoot. This minimizes wear and tear on plant components.



## Low emissions

### Emissions Control

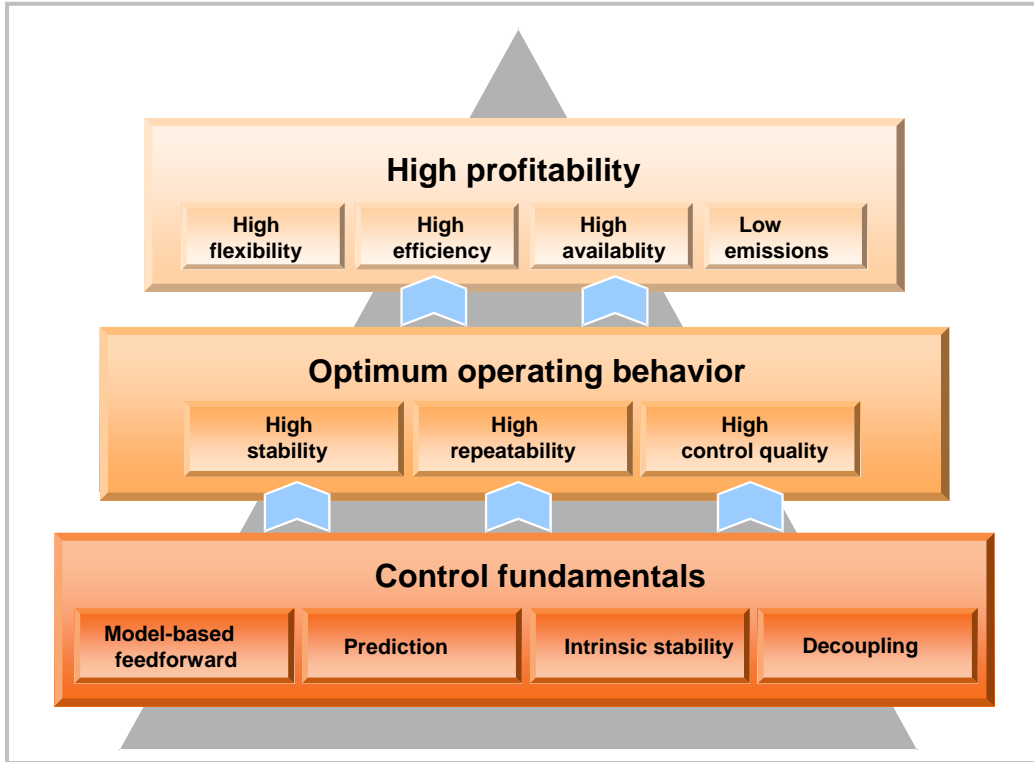
#### Lower emissions

Ever more stringent environmental legislation demands the reduction of power plant emissions. The introduction of trading in emission credits for a number of pollutants even opens up potential for deriving financial benefit from emission reduction by selling excess emission credits.

**Emissions Control** continuously measures emissions and reduces these by precise adjustment of fuel and air flow together with optimum settings for the separate burners.

## The basis: excellent control concepts

Excellent control concepts are at the base of P3000 Solutions. Consistent use of model-based, predictive feedforward structures, exploitation of inherently stable processes and decoupling of highly inter-meshed subprocesses yields optimum operating behavior. As a result, operating behavior is extremely stable, but still features flexible and fast response. These properties lay the foundation stone for high profitability.



## Selected references for SPPA-P3000 Solutions



**Parish, USA**  
 Low Loss Start  
 Minimum Load Reduction  
 Fast Ramp



**ValesPoint, Australia**  
 Fast Ramp  
 Temperature Optimizer  
 Minimum Load Reduction  
 Low Throttling



**Callide, Australia**  
 Fast Ramp  
 Maximum Load Plus  
 Temperature Optimizer  
 Dispatch Control



**Niederaussem, Germany**  
 Fast Ramp  
 Frequency Control  
 Dispatch Control



**Lippendorf, Germany**  
 Fast Ramp  
 Temperature Optimizer  
 Frequency Control



**Karlsruhe, Germany**  
 Fast Ramp  
 Fast Start  
 Frequency Control  
 Dispatch Control



**Simmering, Austria**  
 Low Loss Start  
 Temperature Optimizer  
 Low Stress  
 Dispatch Control



**Plomin, Croatia**  
 Fast Start  
 Temperature Optimizer  
 Fast Ramp  
 Frequency Control



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Solutions

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Overview "SPPA-P3000 Solutions  
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